

## **REMARKS**

Claims 1-13 are pending.

Claims 1-13 stand rejected.

Claims 1 has been amended. Support for this amendment can be found throughout the specification, as originally filed.

### **REJECTION UNDER 35 U.S.C. § 103(a)**

Claims 1-13 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Tang et al. (Chinese Patent No. 1449997), in view of Kistler (U.S. Patent No. 2,249,767) and White et al. (U.S. Patent No. 2,807,588).

The Applicant respectfully traverses the 35 U.S.C. § 103(a) rejection of claims of 1-13.

The standard for obviousness is that there must be some suggestion, either in the reference or in the relevant art, of how to modify what is disclosed to arrive at the claimed invention. In addition, "[s]omething in the prior art as a whole must suggest the desirability and, thus, the obviousness, of making" the modification to the art suggested by the Examiner. *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 1051, 5 U.S.P.Q.2d (BNA) 1434, 1438 (Fed. Cir.), cert. denied, 488 U.S. 825 (1988). Although the Examiner may suggest the teachings of a primary reference could be modified to arrive at the claimed subject matter, the modification is not obvious unless the prior art also suggests the desirability of such modification. *In re Laskowski*, 871 F.2d 115, 117, 10 U.S.P.Q.2d (BNA) 1397, 1398 (Fed. Cir. 1989). There must be a teaching in the prior art for the proposed combination or modification to be proper. *In re Newell*, 891 F.2d 899, 13 U.S.P.Q.2d (BNA) 1248 (Fed. Cir. 1989).

If the prior art fails to provide this necessary teaching, suggestion, or incentive supporting the Examiner's suggested modification, the rejection based upon this suggested modification is error and must be reversed. *In re Bond*, 910 F.2d 831, 15 U.S.P.Q.2d (BNA) 1566 (Fed. Cir. 1990).

The law is also clear that a claim in dependent form shall be construed to incorporate all the limitations of the claim to which it refers. 35 U.S.C. §112, fourth paragraph.

Tang et al., Kistler, and/or White et al., either alone or in combination therewith, do not disclose or suggest the invention as claimed in independent claim 1, as amended, or the claims dependent therefrom.

In the interests of expediting prosecution of the instant application, and without admission that any amendment is required, the Applicants have amended claim 1 to recite, among other things, a method for producing a silica aerogel, which comprises combustion of rice husk until the white ash is obtained, dissolving rice husk ash in aqueous sodium hydroxide, heating and stirring the resultant gel mixture to produce a sodium silicate solution, adding concentrated sulphuric acid to the resulting water glass solution to convert the sodium silicate to silica and produce a silica hydrogel, aging the hydrogel to allow the gel structure to develop, displacing the water by subjecting the hydrogel to a C<sub>1</sub> to C<sub>4</sub> alcohol vapor through a repetitive cycle of condensation and evaporation, to produce an alcogel, and subjecting the alcogel, to super critical drying with additional alcohol to form an aerogel.

As a comparison, although step “1(5)” as described by Tang et al. and instant claim step “(f)” of the present invention are performed to displace water with alcohol, both steps have a differing treatment approach. In the prior art, the hydrogel is soaked

with alcohol before supercritical drying. The soaking step has also been described under the Background of Invention in the present specification as a commercially known method. However, the present invention discloses a different method by using a Soxhlet extraction technique wherein a hydrogel sample is placed above boiling alcohol to be subjected to an alcohol vapor for allowing water displacement.

In the present invention, the Soxhlet extraction is performed by contacting the hydrogel with a solvent of hot alcohol vapor to increase the water extraction rate. During the extraction process, the vapor mixture of alcohol and water will be condensed in the condensor and the solvent and extracted water is to be transferred back into the lower flask. The solvent is then reheated to a boiling temperature and the water extraction process is repeated until the water has been completely extracted to be contained in the lower flask. Advantageously, this technique can reduce the time of extraction by a fast water displacement rate through the azeotropic mixture. The treated gel sample as suspended in the extractor can be taken out without further separation. The mixture of alcohol and water can also be easily replaced by pure alcohol and recycled by distillation.

The prior art discloses a displacing time during the soaking step in 20-50 hours and ideally 30-40 hours. As disclosed in an example of a preferred embodiment of the present invention, the displacing time by alcohol has taken about 16 hours, which indicates a much shorter time period than that of the prior art to obtain the alcogel product.

The disclosure of Tang et al. has indicated CO<sub>2</sub> supercritical drying during a preparation method of the aerogel. Nevertheless, the present invention has described supercritical drying by using additional alcohol in which under its supercritical

condition shall form as a vapor. Instead, supercritical drying with CO<sub>2</sub> is indicated as an optional step in the present specification. The critical temperature of CO<sub>2</sub> is different from C<sub>1</sub>-C<sub>4</sub> alcohols, and so is the supercritical condition.

Additionally, it is not known from Tang et al. of a pretreating step on the rice husk by using sulphuric acid solution before combustion. According to the present invention, the pre-treating step can increase the purity of silica contained in rice husk to above 98%. The presence of more pure amorphous SiO<sub>4</sub> tetrahedra can increase the reactivity of silica.

The Examiner stated that Tang et al. discloses purifying by leaching with sulfuric acid to improve silica purity. However, this assertion is not found in Tang et al. Instead, according to Tang et al., an acid treating step is carried out as a later step after rice husk combustion for the purpose of pH neutralization and formation of silica hydrogel. As a result, the rice husk used in the prior art that is not pre-treated by acid will have a lower purity of silica. In comparison with the given examples as described by Tang et al., basically a higher amount of a similar concentration alkaline solution is required to react with a similar amount of rice husk ash than in the present invention.

The recitation of Kistler and/or White et al., either alone or in combination therewith, does not cure the deficiencies in the disclosure of Tang et al.

Kistler discloses a method of producing hydrogel by starting with the step of reacting sodium silicate with sulfuric acid. There is no further disclosure of a silica source being used or the formation of a sodium silicate in any appreciable detail. However, the present invention discloses the use of rice husk which is to be incinerated and dissolved in aqueous sodium hydroxide. This resultant mixture is

then heated and stirred to produce the sodium silicate. Rice husk is a preferred silica source than other conventional materials which can be more expensive and toxic.

With respect to White et al., there is no disclosure or suggestion of using rice husk as a silica source to produce an aerogel. In the present invention, rice husk is used as a suitable silica source because it is rich in silica and can be obtained cheaply as a waste material. Moreover, White et al discloses a different method of producing the aerogel. White et al. does not disclose or suggest water displacement by using an alcohol nor a supercritical drying step of an alcogel by CO<sub>2</sub> or additional alcohol.

As previously stated, the main objective of the prior art is to produce a silica aerogel which has substantially free metallic cations. Therefore, the step of washing the hydrogel with distilled water or acidified water is required. The washed hydrogel is then heated in a closed system to a temperature of 340-500°C until the water is converted to a vapor. The present invention has disclosed that the drawback of using such severe temperature conditions can cause accelerated aging of the sol-gel samples. It is therefore preferred that the water should be replaced by a lower critical temperature liquid medium such as alcohol.

As disclosed in the prior art, because water has an inconveniently high critical temperature and critical pressure, this can cause some gels to dissolve before the critical condition is reached. Silica is precipitated as a very voluminous powder when the water is released. To obtain a more desirable product, the water is replaced by alcohol via soaking the gel preferably at least one time. Likewise, in the present invention, a water displacement step by alcohol is also implemented but the step is achieved via a Soxhlet extraction technique in which a gel sample is placed above boiling alcohol and subjected to the alcohol vapor.

The Applicants submit that the 35 USC §103(a) rejection of independent claim 1 has been overcome or rendered moot. Because claim 1 is allowable over Tang et al., Kistler, and/or White et al., either alone or in combination therewith, for at least the reasons stated above, claims 2-13, which depend from and further define claim 1, are likewise allowable.

### **CONCLUSION**

In view of the foregoing, the Applicants respectfully request reconsideration and reexamination of the Application. The Applicants respectfully submit that each item raised by Examiner in the Office Action mailed March 26, 2010 has been successfully traversed, overcome or rendered moot by this response. The Applicants respectfully submit that each of the claims in this Application is in condition for allowance and such allowance is earnestly solicited.

The Examiner is invited to telephone the Applicants' undersigned attorney at (248) 601-6666 if any unresolved matters remain.

**Respectfully submitted,**

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**Date**

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